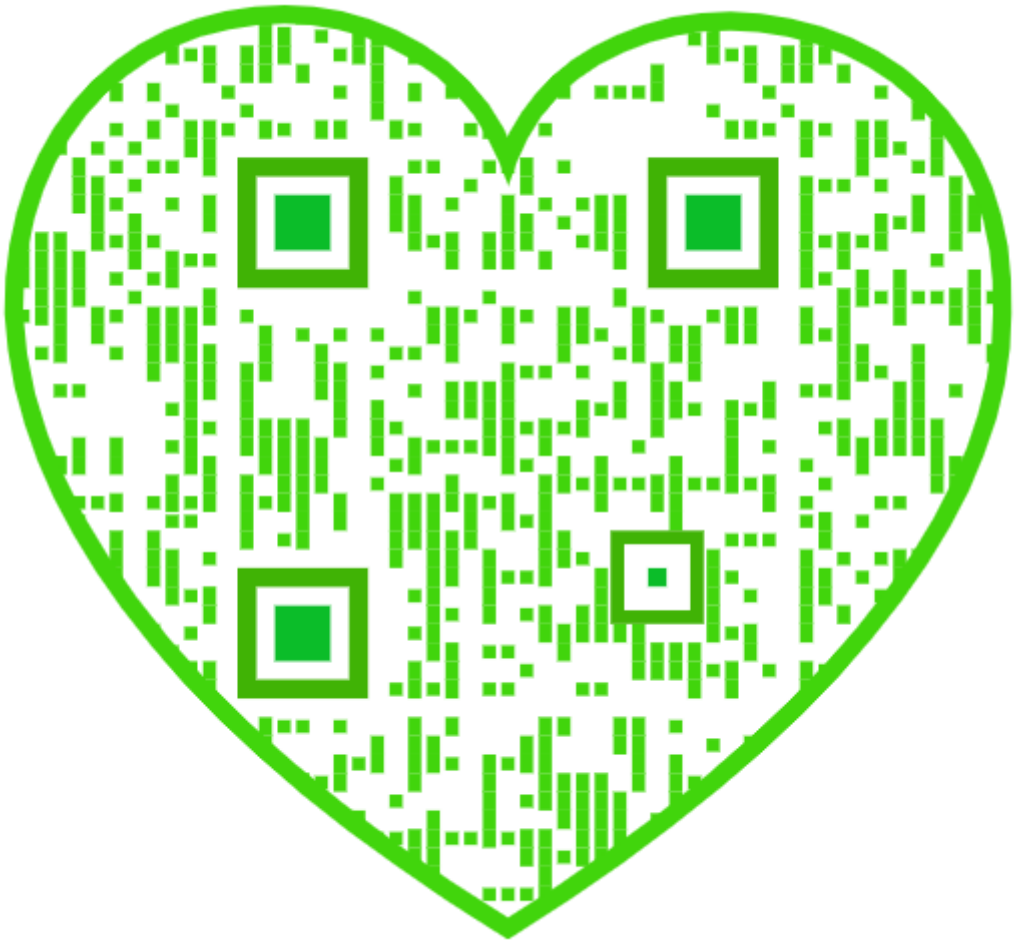

THE

ART AND PRACTICE

OF

SILVER PRINTING.

BY

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PREFACE.

SILVER printing has been often doomed, but it still survives. Other processes of photographic printing have been introduced, nearly all of them having their individual merits, especially that of permanency, but all lacking in two essential qualities—ease of production and beauty of result. In these particulars no process has ever approached the one to the working of which this little book is devoted. The one defect of silver printing is the possibility of its results fading; but surely it is better to be beautiful, if fading, than permanent and ugly. It is better to be charmed with a beautiful thing for a few years, than be bored by an ugly one for ever. But is silver printing necessarily a fading process? We have in our possession a large number of silver photographs produced from twenty to twenty-five years ago, which are as perfect in tone and colour as when they were produced. Carefully prepared, and properly kept, a silver print should be as permanent as any other. That silver prints should be permanent as well as beautiful, has been the object of

THE AUTHORS.

From this we may gather that the action of light on them is of a totally different nature.* This is also most marked if we treat the two with hydrosulphuric acid solution (sulphuretted hydrogen†). It will be found that the colour of the darkened silver chloride becomes more intense, while the other is bleached, or, rather, becomes of a yellow tint. This last effect has an important bearing on the permanency of silver prints, as will be more fully explained when considering the subject of fixing the print.

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* With the former we have this action—

Silver Chloride gives Silver Sub-chloride and Liberated Chloride.

$$Ag_2Cl_2 = Ag_2Cl + Cl$$

With the latter the silver in combination with the organic matter, which is in a state of oxide, is probably reduced to the state of sub-oxide.

† Sulphuretted hydrogen may be prepared by pouring dilute sulphuric acid on ferric sulphide. The chloride or the silver compound, when damped, may be held over it, taking care that no liquid is spirted up on to it.

CHAPTER II.

PREPARATION OF ALBUMENIZED PAPER.

In printing on albumenized paper we must divide the operations, and give a detailed account of each. In case the reader may desire to prepare his own paper, we give the following formula and directions.

To prepare the albumen, procure a sufficient number of eggs, remembering that the white of a large egg will be about a fluid ounce; have a cup to collect the yolks, and a four-ounce measure at hand. Give the centre of the egg a smart blow against the top of the cup. The shell can now be readily pulled in two, the yolk remaining unbroken with part of the albumen in one half, and the rest of the albumen in the other half of the shell. Take the halves, one in each hand, and pour the albumen from one to the other, holding them over the small measure. As the operation continues, the yolk will gradually separate, the white falling into the vessel below. If conducted with care, the whole of the latter will be collected without breaking the yolk. If the yolk break, some will be sure to find its way into the measure along with the white, and this, together with the white speck known as the tread, must be rigorously taken out by means of a spoon. The *uncontaminated* white is then poured into a large jar. If the operator carefully collect the white of each egg into the four-

ounce measure first, he will find his labour much diminished, as it is awkward to get out the small pieces of yolk from a large quantity of albumen. The eggs are thus broken, and the white collected till there is a sufficient quantity for the purpose in hand. Suppose we are going to make up 20 ounces of solution, then about 18 ounces of white of egg must be found in the jar. One point to settle is the amount of salt to be used to each ounce of albumen. It must be recollected that a medium quantity is the best for medium negatives; anything between 20 and 40 grains per ounce may be used. We prefer ourselves about 25. Supposing this quantity to be used, we proceed to dissolve 500 grains of chloride of ammonium in 2 ounces of water, and add it to the albumen. It has been proved that as regards colour of the picture, it does not matter what chloride is used. To prevent crystallization, it is better to use ammonium, which contains a greater amount of chlorine than do sodium or potassium chlorides. It must now be beaten up till it is in a froth. This breaks up the fibrous matter, and on subsidence the liquid will be found to be limpid. The most convenient implement with which to beat up the albumen is the American egg-beater. Three or four minutes' work is quite sufficient to make the whole into a froth. An ordinary culinary whisk, such as is used in the kitchen, may also be put into requisition, or, in default of that, a bundle of quill pens. A lesson in producing a froth can be learnt from the cook of the establishment. When the salted albumen has settled it must be filtered, which, perhaps, is best effected through a sponge, though glass-wool is a capital substitute. In either case a small, loosely-fitting plug is placed in the neck of an ordinary funnel, and, after rinsing with cold water, the albumen is poured in, and allowed to filter through slowly. It is advisable to avoid bubbles as far as possible, and the accompanying arrangement will be found to avoid their formation. The funnel is placed in the position shown (fig. 1); the capillary attraction between it and the glass will cause the drops to trickle

obtained by the gallon in this condition, according to the price of eggs. It will be evident that there is considerable economy in taking the whites wholesale. As a rule, about three gallons of albumen will coat two reams of albumenized paper. Mr. England (to whom we are indebted for so many of our remarks on albumenizing paper) procures about the latter quantity at a time, and beats it up mechanically in a large vat holding some fifty gallons, in order to allow space for the froth. He allows the albumen to rest four days before employing it, and filters it through three thicknesses of flannel.

The quality of paper to be used varies considerably with the custom of the printer. Thus, in some countries, we find a much thinner paper used than in England. The great desideratum is that it should be perfectly opaque to transmitted light. A good test of this is to make a couple of black ink marks on a piece of white paper, and then press down firmly the paper it is proposed to employ over this. If the black ink marks are indistinguishable, the paper will do as regards this quality, as the light reflected from the surface which gives the impression of whiteness to the eye is much stronger than the light which penetrates through it, and is absorbed by the black lines. As to quality, it is best to trust to the manufacturer, those known as Saxe and Rives papers answering better than any other that we know of. The Rives is, when moist, a paper which is more easily torn than the Saxe, and, consequently, we recommend that the former be employed for small work, such as portraits, and the latter for large landscape prints.

In regard to the sizes to be albumenized, it must be left to the operator to say what will be the most useful to him. It is rarely advisable to albumenize less than a half sheet of paper, the whole size of which is about 22 by 18 inches; 11 by 18 is not an inconvenient size to manipulate. At any rate, a dish larger each way by a couple of inches than the paper must be procured, and put on a level table. The temperature of the room should be at

Two large dishes are usually employed, and by the time the second sheet is floated in the second dish, the first sheet of paper is ready for removal from the first dish. The sheets, when slowly removed from the bath, are allowed to drain a few seconds, and then thrown over wooden rods of some two inches in diameter, which are removed to a rack, and placed near a trough to collect the drainings.* When drained sufficiently the rods are removed to other racks, and the paper allowed to dry spontaneously.

It is the practice of some albumenized paper manufacturers to hang the sheets over a line, uncoated side next the line; but this is a mistake, as it will nearly always be found, on sensitising the paper and exposing it, that a mark is left across the paper corresponding to the part where the string touched the back of the paper.

In practice we have found that each sheet of paper takes up about $\frac{1}{3}$ oz. of solution, and, of course, its equivalent quantity of salt. The principal difficulty in albumenizing paper is the occurrence of lines on the paper in the direction in which it was placed on the surface of the albumen. Any arrest of motion in floating the paper will cause them, but more usually it is due to imperfect beating up of the solution. Some papers are not readily coated with albumen, in which case the remedy given above may prove effectual; or a little solution of oxgall may be equally well applied. A want of gloss in the dried albumen may be due to too long a floating on the fluid, or to floating and drying the paper in too low a temperature. The explanation of the first cause is that albumen, when fresh, has an alkaline reaction, due to the presence of a small quantity of soda, which may be said to be its base, and any alkali will dissolve the gelatinous sizing of a paper. When the sizing is dissolved, instead of re-

* The drainings are added to the next batch of albumen which is prepared.

maining on the surface, the albumen sinks into the paper, and thereby the gloss is lost.

When albumen is stale it no longer possesses this alkaline reaction, but has an acid reaction quite visible on the application of blue litmus paper to it; the blue colour disappears and is replaced by a red tint. When in the alkaline state, the paper is much more difficult to coat, but an acid condition means the production of inferior tones.

Rolling the Paper.—The paper, when dried, is often rolled with a heavy pressure to improve the gloss; a copper-plate press is found to answer admirably, placing the albumenized side next the bed. This rolling should not be necessary if attention be paid to the temperature of the preparation room. The higher the temperature the finer will be the gloss, as we have already said.

chloride than for the albuminate, and that in an equal mixture of the two more chloride would be formed than albuminate; in other words, that the ammonium chloride would be totally converted into silver chloride long before the silver albuminate was formed.

2nd. That a certain strength of silver nitrate is necessary to prevent the albumen dissolving from off the paper.

This last fact has fixed the lowest strength of any sensitizing solution to be thirty grains to the ounce, and even if this be taken as a limit, it is necessary that the water should be rendered less active by holding some other soluble matter in its embraces. This is usually effected by adding some other neutral and inactive nitrates. There does not seem to be any theoretical limit to amount of silver nitrate in solution, but practically it rarely contains more than 80 grains to the ounce, though occasionally we have heard of it being used of a strength of 100 grains to the ounce.

The important point now presents itself. How are we to fix the strength of the bath? What principles must we follow?

To answer these questions we extract a passage from another work of this series.*

"If a paper be coated with albumen (say) in which has been dissolved a certain quantity of a soluble chloride, and floated on a silver solution, both chloride and albuminate of silver are formed. It depends, however, on the strength of the solution as to what proportions of each are present, owing to the fact that the organic compound is much slower in formation than the chloride, and has less affinity for the silver. If the silver solution be not sufficiently strong, the chloride may rob that portion of it with which it is in contact of all the silver before any (or, at all events, sufficient) albuminate has been formed, the molecule being composed almost entirely of silver chloride. The stronger the silver solution the

* "Instruction in Photography," 4th edition, page 121.

more 'organate' will it contain; whil t if it be very weak, very little will be present. Hence it is with albumenized paper which is weakly salted with a silver chloride a weak sensitizing bath may be used, whilst if it be rich in the chloride it must be of proportionate strength."

It will now be seen that the proportion of chloride to albumen has to settle the point. We next have to consider the time during which the silver should be in contact with the paper when the floating is commenced. Let us take the case of a strong silver solution, and consider the action that will follow. Immediately the paper is placed in contact with the solution, silver chloride is formed, and the amount of the silver nitrate in the layer of fluid in immediate contact with the surface being scarcely diminished by the formation of silver chloride, the albuminate is formed almost simultaneously, forming a film which is to a great extent impermeable to the liquid. But even before this layer is coagulated, the next layer of chloride will have been formed, so that we may say we have one layer of albuminate and chloride of silver, and one layer of chloride of silver alone.

The further penetration of the silver solution will be very slow; hence, for fully saturating both the albumen and the salt with silver, the time of flotation must be prolonged. For some purposes, however, this is not necessary, as will be seen presently.

Next let us trace the action of a weak solution, not weak enough to dissolve the albumen off the paper, but of the minimum strength. The solution, as before, would immediately form the silver chloride, but before the albumen had coagulated at the surface, the solution would penetrate to the interior of the film, and then the formation of the albuminate would proceed nearly equally throughout the whole of the interior. Evidently, then, in this case, the contact of the silver solution would be less prolonged than in the former case. If the floating be prolonged the silver solution in the interior will become weakened, and par-

and a fair estimate of the chloride present can be gained from such directions.

A weak solution loses much of its strength by each sheet of paper floated, much more proportionally, in fact, than a strong solution, since the same amount of fluid is absorbed by the paper in each case, whilst the amount of silver abstracted from the *whole* is also equal, which reduces the strength per ounce more with the former than with the latter. A weak sensitizing solution, therefore, requires much more attention than a strong one: crystals of silver nitrate must be constantly added to the former. In practice and for general work, then, we recommend a moderately strong bath, the method of making up of which we shall describe.

To make up 2 pints of solution with a strength of 50 grains to the ounce, we shall require 2,000 grains of silver nitrate. This is carefully weighed out in the scales, a piece of *filter paper being placed in each pan.* By adopting this plan freedom from all impurities that may cling to the pans will be avoided, and the silver nitrate will be perfectly pure. Place the silver salt in a large clean bottle, and add half-a-pint of water to it, and shake it to dissolve it. The best water for the purpose is distilled water; but filtered rain, pure spring, or river water answers well. If the water contain any chlorides, it will be shown by a milkiness due to a formation of silver chloride. This must be filtered out when the remaining pint and a-half of water is added. The solution is now ready for use, and, being of the simplest character, is not to be excelled, though the addition of some soluble salts may be advantageous, particularly in dry climates or in very dry weather. Such salts are found in sodium nitrate, or ammonium nitrate, as much as equal weights of either of these substances being added. Thus our formula would stand as follows were these additions made:—

Original Solution.

1.—Silver nitrate	50 grains
Water	1 ounce

in water alone. The nitric acid evidently attacks the albumen. Nitric acid decomposes the carbonate of silver (which, be it remembered, is an insoluble body), forming silver nitrate, and liberating carbonic acid.*

Alum in the printing bath has also been recommended for preventing the bath from discolouring, and it is effective in that it hardens the surface of the albumen; but the ordinary explanation of its effect is defective. If a solution of common alum be added to the silver nitrate we get silver sulphate (which is best out of the bath, and it is slightly soluble in the solution), and aluminium nitrate is formed.†

The same effect would be produced if aluminium nitrate were added to the bath solution. We, however, give a means of adding it as recommended by some writers. When filtering the solution, put a small lump of alum in the filter paper, and pour the solution over it, or add one grain of alum to every ounce of solution, and then filter.

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*Nitric Acid and Silver Carbonate give Silver Nitrate and Carbonic Acid and Water.

$$\overbrace{2HNO_3}^{\text{Nitric Acid}} + \overbrace{Ag_2CO_3}^{\text{Silver Carbonate}} = \overbrace{2AGNO_3}^{\text{Silver Nitrate}} + \overbrace{CO_2}^{\text{Carbonic Acid}} + \overbrace{H_2O}^{\text{Water}}$$

†Silver Nitrate and Aluminium Sulphate (Alum) give Silver Sulphate and Aluminium Nitrate.

$$\overbrace{6AgNO_3}^{\text{Silver Nitrate}} + \overbrace{Al_2(SO_4)_3}^{\text{Aluminium Sulphate (Alum)}} = \overbrace{3(Ag_2SO_4)}^{\text{Silver Sulphate}} + \overbrace{2Al(NO_3)_3}^{\text{Aluminium Nitrate}}$$

CHAPTER IV.

HOW TO KEEP THE SENSITIZING BATH IN ORDER.

Experience tells us, however strong we may make the bath solution to coagulate the albumen on the paper, that a certain amount of organic matter will always be carried into it. At first this is not apparent, since it remains colourless in the solution; but after a time, after floating a few sheets of paper, the organic silver compound gradually decomposes, and the solution becomes of a brown or red tint, and if paper were floated on it in this condition there would be a dark surface and uneven sensitizing. It is, therefore, necessary to indicate the various means that may be employed to get rid of this impurity. The earliest, if not one of the best, is by the addition of white China clay, which is known in commerce as kaolin. A teaspoonful is placed in the bottle containing the solution, and well shaken up; the organic matter adheres to it, and precipitates to the bottom, and the liquid can be filtered through filter-paper or washed cotton-wool, when it will be found decolourized. Another mode of getting the liquid out of the bottle is to syphon it off by any syphon arrangement, and this prevents a waste in the solution from the absorption of the filtering medium. The accompanying arrangement (fig. 4) will be found useful for the purpose, and can

of nitric acid.* This must be neutralized unless a little silver carbonate is left at the bottom of the bottle as described at page 20. A camphor solution may also be added for the same purpose. Make a saturated solution of camphor in spirits of wine; and add a couple of drachms to the solution, and shake well up. The camphor will collect the albumen, and it can be filtered out. In case the first dose does not decolourize it, another one must be added.

Another plan is to add potassium permanganate (permanganate of potash) to it, till such time as the solution takes a faint permanent rose tint. The theory is that the organic matter is oxidized by the oxygen liberated from the permanganate, and falls to the bottom. It is not strictly true, however, and the solution will never be as free from organic matter as when the other methods are employed.

The final and best method is to add a small quantity of sodium carbonate (say 5 grains), and expose it to daylight. When the organic matter becomes oxidized at the expense of the silver nitrate, the metallic silver with the oxidized organic matter will fall to the bottom. This plan answers admirably when time is no object, but in dull weather the action is slow. When once the precipitation fairly commences it goes on quickly, and if a little freshly precipitated metallic silver be left at bottom of the bottle the action is much more rapid. This is a wrinkle worth remembering in all photographic operations where precipitation is resorted to.

We have hitherto supposed that the only contamination of the bath is organic matter, but it must be borne in mind that each sheet of paper floated on the solution transfers a certain

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Silver Nitrate	and	Hydrochloric Acid	give	Silver Chloride	and	Nitric Acid.
$AgNo_3$	+	HCl	=	AgCl	+	HNO_3

amount of nitrate of the alkali* with which the albumen is salted.

It will thus be seen that in an old bath there will be no need to add the soluble nitrates given in page 17, since they will be already formed. When they are in excess the best plan is to precipitate the silver by some means,† but we select one which is easy of application, since it requires no watching. Evaporate the solution to half its bulk, and slightly acidify it with nitric acid (10 drops to the pint of solution will suffice); throw some ordinary granulated zinc into the jar or bottle containing it; the silver will now be rapidly thrown down in the metallic state, and in the course of two or three hours the action will be complete. Next carefully pour off all the fluid as close as possible to the residue. Pick out all the lumps of zinc, and add a little dilute hydrochloric acid to dissolve up all the small particles of zinc which may be amongst the precipitated silver. Filter the solution away, and wash the residue once or twice with water. Take out the filter paper, and dry it before a fire, or in an oven, and then detach the silver, and transfer it to a small crucible, which place, with its contents, over a Bunsen burner or spirit lamp flame till it is red hot. The heat will destroy all organic matter, leaving a residue of carbonous matter behind, which, after subsequent operations, will be eliminated by filtration. Next cover the silver with nitric acid,‡ and in an evaporating dish slightly warm it over a spirit lamp or Bunsen burner. Red fumes will appear, and when all action has ceased, more acid must be added till such a time

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* Suppose it is salted with ammonium chloride, we have—

Ammonium Chloride	and	Silver Nitrate	give	Ammonium Nitrate		Silver Chloride
NH_4Cl	+	$AgNo_3$	=	NH_4,NO_3	+	$AgCl$.

† Several other methods are given in "Instruction in Photography," in the Appendix.

‡ One part of nitric acid to 4 parts of water.

CHAPTER V.

APPLYING THE SILVERING SOLUTION TO THE ALBUMENIZED PAPER.

As each piece of paper takes somewhere about five minutes to sensitize and hang up to dry, it is evident that the larger the piece of paper sensitised the greater will be the saving in time in this operation. Practically a whole sheet of paper, which is about 22 inches by 18, is the maximum ordinary size, whilst it may be convenient to float a piece as small as $3\frac{1}{4}$ by $4\frac{1}{4}$. There is not much difficulty in floating either one or the other if ordinary care be taken, but it is no use disguising the fact that large sheets are sometimes faultily sensitized even by experienced hands, if the solution be not in a proper state. The great enemy to success is the formation of bubbles on the surface of the solution, and if it be at all contaminated with organic matter they are more liable to be met with than if the bath be new. It may be taken as a maxim that no paper should be floated if, to commence with, the bath be not purified. A flat dish of about $2\frac{1}{2}$ inches in height, and an inch larger in breadth and length than the paper to be floated, is used, and the solution poured in to a depth of $\frac{1}{2}$ inch. The paper is grasped by the two hands as shown at page 10, so that a convex albumen surface is formed downwards, which is placed diagonally across the dish and lowered on to the surface of the solution; the hands are at the

same time separated outwards, so that the whole surface of the paper is caused to float on it without any arrest. By this means all air is forced out before the paper, and no bubbles should be beneath. To make assurance double sure, the paper is raised from the corners which were not grasped by the hands, and if by any chance a small bubble should be found, it is immediately broken by the point of a clean quill pen or glass rod. Before floating the paper the surface of the solution should be examined for scum or bubbles, both of which may be removed by passing a strip of clean blotting-paper across it. The dish employed should be scrupulously clean, and in cold weather it is a good plan to warm both it and the solution before the fire previous to use. In warm weather, the albumen of the paper may be in a very horny condition, which increases the liability to form bubbles. The writers have found that if the sheet of paper be exposed to the steam passing from a kettle of boiling water for a few seconds (moving it so that every portion shall come in contact with it) just before sensitising, the surface becomes more tractable, and in a better condition for sensitizing; keeping the paper in a moist atmosphere effects the same end.

The length of time for floating the paper depends on the subjects to be printed, *but, as a rule*, three minutes with the 50-grain bath will be found to answer for the majority of negatives. When the proper time has elapsed, a corner of the paper is raised from the solution by means of a glass rod, and grasped by the thumb and forefinger of the right hand. It is then raised *very slowly* from off the solution till another corner is clear, when that is grasped by the forefinger and thumb of the left hand; and it is finally withdrawn entirely, and drained a minute from the lowest corner into the dish. It is next hung up to dry by a corner which should be fastened to an American clip (fig. 7) suspended from a line stretched across the dark room, taking care to keep the corner which last left the solution the lowest. A piece of *clean* blotting-paper about one inch long by ½ an inch wide is brought in contact

be near. The sheet, having assumed a convex form, is drawn by the left hand across the dish, the right hand being gradually turned to allow the whole surface to come slowly in contact with the solution. Air-bubbles are said to be avoided by this means, though for our own part we see no practical advantage in it over the last method.

Some operators also, when lifting the paper from the dish, pass it over a glass rod placed as in the figure, in order to get rid of

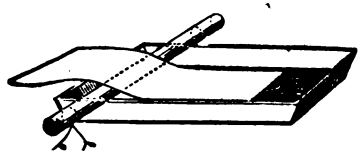

Fig. 9.

all superfluous fluid from the surface. This is a poor substitute for withdrawing the paper slowly from the dish, since capillary attraction is much more effective and even in its action than this rude mechanical means. By those who do not possess patience, however, it may be tried. Some practical photographers also "blot off" the excess of silver, but this is a dangerous practice unless there is a certainty that no "anti-chlor" has been used in preparing the blotting-paper. For our own part we recommend the usual mode of draining the paper. When surface dry, it can be dried in a drying box. The following is a kind which has been adopted by one eminent photographer, and is excellent in principle.

Over a flat and closed galvanized iron bath erect a cupboard. Fig. 10 gives the elevation, and fig 11 the section. A is the bath, D the cupboard, which may conveniently be closed with a roller shutter,* B, passing over *c c*, and is weighted by a bar of lead,

* The shutter may be made of American leather, covered over with one quarter-inch strips of oak or well-seasoned pine. The shutter should fit into a groove formed along the sides and bottom of the front of the cupboard.

so as to nearly balance the weight of the shutter when closed. A couple of Bunsen gas-burners, E E, heat the water in A; the steam generated is carried up the flue F, which also carries off

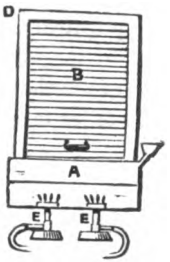

Fig. 10.

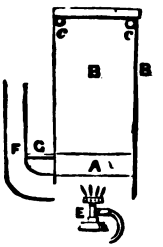

Fig. 11.

the products of the combustion of the gas. The paper may be suspended from laths tacked at the top of the cupboard by means of American clips.

and, unless some other substance which can absorb chlorine be added to the last wash water, care should be taken not to soak out all the free nitrate, as then the paper would produce flat prints. It is then hung up to dry as before. Immediately before use it must be fumed with ammonia, in order that the prints may be "plucky," and free from that peculiar speckiness of surface which is known to the silver printer as "measles." We can readily trace the "measles" to their source. Suppose all free silver nitrate is washed away, and the paper be then exposed to light, the chloride is rapidly converted into subchloride, and chlorine is given off (see page 5); if there be nothing to absorb it at once it will attack the albuminate, which is blackened at the same time, and fresh chloride will be formed in little minute spots. These discolour, and are of different tint to the rest of the print, and give rise to the appearance of measles. This, of course, is not so marked when a little free silver nitrate is left in the paper; but as what is removed is principally removed from the surface, it may still be unpleasantly discernible. Fuming obviates it entirely if properly performed, for chlorine and ammonia combine to form finally ammonium chloride, a neutral and inactive salt.

Any other chlorine absorber may be substituted; thus citric acid, potassium nitrite, and many others are effective, and cause vigorous prints to be produced. Perhaps the easiest way of giving the paper the necessary amount of ammonia is that recommended by Colonel Wortley. This is to place overnight the pads of the printing-frame, if they be of felt, into a closed box in which is placed a saucer containing a couple of drachms of liquor ammoniæ, and to withdraw them as required for the printing-frames. The pads will be thoroughly impregnated with the vapour of ammonia, and a couple or more prints, in succession, may be made before it is necessary to change them.

The ordinary method of fuming is that used in America. Hearn describes a box, which is very convenient and simple in

construction. He says: "Take any common wooden box, large enough for the purpose, and make a door of suitable size for it, which, when shut, will totally exclude all light. Make a false bottom in this about six inches, or so, from the real one, and perforate it with holes of about the same size that a gimlet would make. These holes should be very numerous, and at the centre there should be, if anything, a smaller number of them, because the saucer containing the liquor ammonia is generally placed at the centre of the real bottom of the box."

For our own part we dislike the false bottom as constructed, and recommend one of fine gauze, and, instead of placing half-an-ounce of ammonia in the saucer as Hearn directs, we prefer to soak half-a-dozen sheets of blotting-paper in ammonium chloride solution, about 20 grains to the ounce, and the same number of sheets soaked in lime water; one sheet of each are placed together, and ammonia is liberated by double decomposition; calcium chloride being also formed.

This method is excellent in hot, dry weather, since it imparts a certain amount of moisture to the paper. In damp weather it is a good plan to dry the vapour by sprinkling on the gauze calcium chloride, which will rapidly absorb the aqueous vapour, and will allow the ammonia to pass on unimpeded. The sheets of paper are held at the top of the box by American clips, suspended from laths about three inches apart, and it is not a bad plan to fasten a lath on to their bottom edge by the same means, to do away with their curling. To fume a single piece of paper it may be pinned up to the inside of the top of the lid of a box, and a drachm of ammonia sprinkled on cotton wool distributed at the bottom. The point to be attended to is that the fuming shall be even, and it is evident that the ammonia should rise equally from any part of the bottom of the box. In the plan of the box given above, the bottom of the sheet is apt to get a little more ammonia than the top. The time of fuming depends on so many things that a rule can scarcely be given

for it; twenty minutes may be considered about the extreme limit.

If this sensitizing bath be acid, the time must evidently be longer than when it is strictly neutral or slightly alkaline; and if the negative be hard, it will require to be less fumed than if it be of a weak nature, since the action of ammonia is to cause rapid darkening in the deep shadows. In hot weather the fuming should be shorter than in cold, since the ammonia volatilizes much more rapidly when the temperature is high. On the whole, we recommend Colonel Wortley's plan of fuming the pads in preference to fuming the paper.

Another mode of preserving the paper from discolouration is to add citric acid to the printing bath, which is effective owing to the fact given at page 32. The following formula is a good one, and has answered with the writer. It is—

Silver nitrate	50 grains
Citric acid	20 ,,
Water	1 ounce

The paper is floated for the ordinary length of time, when it is dried thoroughly and placed between sheets of pure blotting-paper. It will keep in its pristine state for months, if excluded from the air. It is better to fume this paper strongly before use, or the toning becomes a difficult matter.

Ordinary sensitized paper may be preserved for a considerable time if, when dry, it is placed between sheets of blotting-paper saturated with a solution of carbonate of soda, and dried.

Washed sensitized paper is also improved in sensitiveness by floating it for a few seconds on—

Citric acid	10 grains
Potassium nitrite	10 ,,
Water	1 ounce

It can be fumed, when dried, in the usual manner.

"In cutting the paper for very large prints, such as 13 by 16, 14 by 18, 16 by 20, &c., the beginner had best (to obtain the right size) lay over the sensitive paper the proper sized mat that is to be placed over the print when finished, and then cut accordingly. Considerable paper can be saved in this way, and printed in card size.

"There should always be an assortment of different sized mats in the printing room; one of each size will do, which should be kept expressly for this purpose.

"In cutting the paper for an 11 by 14 print, the length of the sheet is generally placed before the printer, and the paper bent over to the further edge of the sheet, and then creased, and thus cut into two equal pieces, one of which can be used for the contemplated print. I would recommend that instead of taking exactly one half of the sheet of paper, as described above, to take about *an inch more* than the half, so as to allow for any slight tear that may happen along the edges of the paper during the washing, toning, &c., and also so as to be sure of having the paper wide enough for the different sized mats.

"I have seen some nice prints printed upon the exact half of a sheet of paper, which, when taken from the final washing (and the edges trimmed, being slightly torn), were then too narrow to be covered with the proper sized mats, and had to be rejected; whereas, if in cutting this paper allowance had been made for this final trimming, the prints would have been saved. The rest of the sheet can be cut very well into sixteen or eighteen carte pieces.

"In cutting cabinets out of a sheet, fifteen is all that can very well be obtained, and to get that number lay the sheet on a wide table, or printing bench (with the length of it running from right to left), and divide it into three equal parts. By laying the cabinet glass on these strips of paper, and cutting the paper a little wider than the glass, five cabinets can be obtained from each strip, and fifteen out of the whole. These pieces will be

plenty large enough, both in length and width; besides, this is a very convenient and economical way to cut the paper without waste.

"By a glance at the cut (fig. 12) it will be seen that the size of the pieces will be $4\frac{2}{5}$ by 6 inches, and consequently there will be more room for the width than there will be for the length. The edges of the width side of the paper can be trimmed a little,

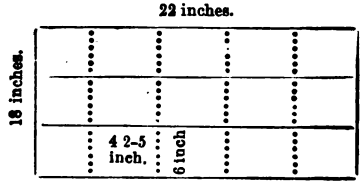

Fig. 12.

as there is usually some little tear, or some other defect, that can thus advantageously be got rid of. Often, when there are only a few cabinets to be printed, I take a quarter-sheet, and bend over the length of it to about three-quarters of an inch of the opposite side, crease it, and then cut with the paper-knife. You thus obtain a large and small piece; the smaller one of these can be cut into four cards, and the larger one can be cut in two, and thus obtain two generous size cabinets; or the printer can use the larger of the two pieces for printing the 4 by 4 size. This is the way I obtain my 4 by 4 pieces when I wish them.

"The beginner must remember that in bending over the *length* of a sheet of paper 18 by 22 inches in size, the divided paper will be 11 by 18 inches in size, which is termed, in the language of the printing room, half-sheet.

"To obtain the quarter-sheet, the *length of the half-sheet* is cut equally in two pieces, and then the size will be 9 by 11 inches.

"A glance at fig. 13 will show that either a generous size 4 by 4, or a couple of nice cabinet pieces, together with four cartes, can be easily obtained from a quarter-sheet.

"To obtain thirty-two cartes, quarter the sheet, and divide each quarter into eight equal pieces.

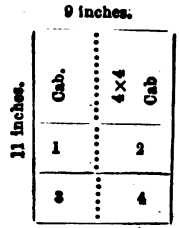

Fig. 13.

"To obtain thirty-six pieces out of a sheet, it is necessary, for convenience, to first quarter it, and then divide it into three equal strips (fig. 14) taken from the *length of* the paper. The

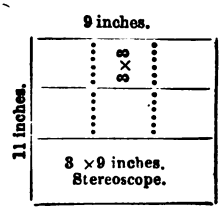

Fig. 14.

pieces, as thus cut, will measure $3\frac{2}{3}$ by 9 inches, which will answer admirably for the stereoscopic size. Each one of these strips of paper can be cut into three good sized cartes, making nine out of a quarter, and thirty-six out of a whole sheet.

"Forty-two cartes can be obtained very neatly by laying the sheet before you (fig. 4), and dividing the length into seven equal parts; when done, each strip should measure $3\frac{1}{7}$ by 18 inches in size. The whole number of pieces will be forty-two. It will be seen that the size of the carte pieces (3 by $3\frac{1}{7}$ inches) only allows very little room for waste paper in trimming after

When large negatives are to be printed, the plate glass front should always have at least an inch clear all round. For smaller negatives (say 12 by 10 and under) half-an-inch

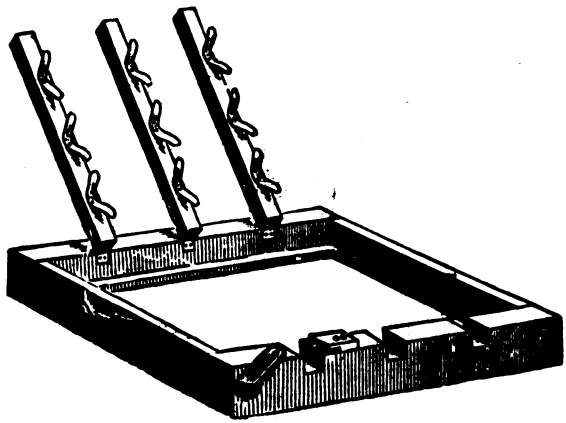

Fig. 14.

clear is sufficient. This allows a certain latitude in the position of the negative, and enables the fingers to get at the paper

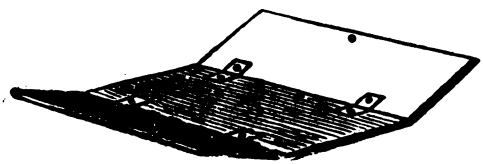

Fig. 15.

without inconvenience. In the frames in which the front of the negative is unsupported this cannot be the case, and for this reason (as well as those given above) they are not recommended for large prints.

in the print by the light penetrating beneath it, and causing the edges of the shadows to print too dark. In this case, which may arise from the negative being taken on a thin glass plate, the parts covering the high lights, and which were cut out, should be indented with a jagged edge such as this, the dotted

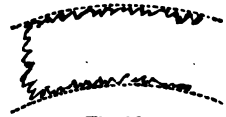

Fig. 16.

line showing where the cut would come if it had been cut out in a clean sharp line. Another mode which we have sometimes found successful, though care is required in employing it, is to coat the back of the plate with a very dilute emulsion of a quarter the ordinary consistency, than to expose it, through the negative, and develop with one of the ordinary alkaline developers (we prefer the ferrous oxalate),* and then fix. This last film may be protected with a layer of albumen 1 part of albumen to 25 parts of water. By this means the shadows become subdued and the contrasts diminished, and there is no danger of any sharp demarcations in the shades being apparent.

There is one way of improving a hard negative, if taken on a gelatine plate, which would probably be dangerous in the hands of a novice, but which is most effective when used with skill and judgment, but must be applied before the plate is varnished. One of the most popular methods of reducing the density of an over-intensified gelatine negative is with a very weak solution of perchloride of iron. The writers have found that the reducing agent may be applied locally. Let us suppose the case of a figure in a landscape in a light dress, which produces a white patch in the print. The negative should be placed in a dish of water, then lifted up until the part to be reduced

* See "Instruction in Photography" (page 67), fourth edition.

(by which we mean the haze always present in the air) in the distance and middle distances, and we have found that by applying one piece of tissue-paper to the back of the negative to cover the middle distance and distances, and another to cover the distance alone, atmospheric effect is produced. The effect of atmosphere is usually shown by grey tones as compared with those of the foreground, and the greyer they are the more distant should the objects be away in nature. This effect is accomplished by the tissue-paper. It must, however, be remembered that the lights of distant objects are greyer than those of the foreground, hence the tissue paper must be used with judgment to prevent the distant lights from appearing too white. This sometimes is effected by giving *the lights in the foreground* a covering of tissue paper. We very much doubt if there exists any landscape negative which would not be improved by the use of tissue paper, since photography often tends to do away with atmosphere. We have, in some cases, strengthened the high lights on the film side with the paint-brush and Prussian blue. This requires skill, and should be done very sparingly. It may be objected that when these artifices are resorted to, that the photograph must of necessity fail in regard to truthfulness. The answer to this objection is quite easy to give. If a photograph were true in itself, they should never be resorted to, but since it always falls short of the truth, it is quite legitimate to give it the effect that a perfect process would do, by which we mean one in which the intensity of the negative is exactly proportional to the intensity of the light producing it.

It has been shown in the PHOTOGRAPHIC NEWS of 1877, that the gradations of a negative are never perfect, and the use of the tissue paper, &c., makes it more nearly in accord with nature.

These remarks, of course, have reference only to what we might call "a good printing negative;" the advisability of doctoring poor negatives is scarcely open to argument. Improve as much as you like, but be very careful not to overdo it.

adjunct during the examination. The cloth is large enough to cover the frame and also the head of the operator. One half of the back is loosened and raised, the half pieces are pulled back, and the paper will probably be found adhering to the negative, and may require a little manœuvring to separate it. A very thin slip (of the size of a toothpick) of soft wood, sharpened at one end, is a good implement to employ, as by inserting it the paper can be separated at one corner, and then be raised by the fingers. We have seen some printers blow against the paper, as if they were separating the leaves of a book from one another, but this method is to be deprecated, since particles of saliva are apt to be carried on to the paper with the breath, and to cause spots, which often appear unaccountable. Should the print appear slightly deeper than it is required to remain, it is probably ready to be withdrawn from the action of light, but the remaining half of the paper must next be examined to see whether such is the case. To do this the first half of the pressure-board of the frame which is loose must be pressed down once more into position, the frame reversed end for end, and the other half of the board opened.

If the print is large (say 15 by 12) it is not advisable to look at much of it at once, or for a longer time than can be avoided. It constantly happens that on a warm day the paper contracts during the short time necessary for a proper examination of the print; the consequence is, that the paper does not fall on the same place on the negative when reflected, and the result is a double print on the paper.

The printing being judged to be complete, the paper is withdrawn by taking off pressure-board and pads, and put away for the further operations of toning and fixing. In one establishment we are acquainted with, the prints when taken from the frame are placed in a box the lid of which is pierced by a hole covered with a dark cloth; whilst others keep them in a press of blotting-paper. The great point to attend to, however, is to

The operator must now be supposed to be cognizant of the operations of toning and fixing which are to be described in subsequent chapters, and that he has the finished trial print of the particular landscape negative before him. He sees whether the middle distance or far distance is obtrusive, and notes which portions require to be softened down by tissue paper, or to be brought nearer by strengthening the high-lights, and eventually forms a picture of it as it should be, centreing his imagination in it as built up round the point of principal interest. He endeavours to see whether the sweeps of light and shade lead up to this principal object in the view, and whether, if light, it is in contrast with an immediate dark part of the picture, or *vice versa*.

Knowing that this is one of the laws of art, he next should endeavour practically to give effect to his imaginative picture by the judicious manipulation of tissue paper, the crayon, and the paint, such as described in Chapter IX. The next point to attend to is as to whether the picture requires clouds or not, and if he have a stock of cloud negatives of the right size, he must endeavour to pick out one, a portion of which will compose well with the lines of the picture,* and at the same time be correct as regards light and shade. When such a negative is selected, it remains to print it in. A white sky is an abomination, and a plain tinted one without gradation is nearly as bad. If, therefore, the operator has the heart and means to do this double printing, he should never neglect to do it.

But we would here remind him that when a sky-negative has been used with a particular view, it should always be devoted to that landscape. Nothing could be in worse taste, or further from nature, than to use the same sky with different landscapes. We once saw a frame of sixteen views, thirteen of which were backed with the same sky; this was bad enough, but the absur-

* See "Pictorial Effect in Photography" (Piper and Carter).

screen over the negative, drawing it backwards and forwards during exposure, taking the precaution that the top of the sky receives the most exposure. The method of using the cloud negative, we have already said, will be found in the chapter on "Combination Printing." Above all things, the printer must bear in mind that if there be any *distance* in the picture, the sky, when it meets the margin, must be only very delicately tinted. Let it be remembered that a picture is often spoilt by printing in clouds too heavily. The clouds for an effect should be most delicate, with no heavy massive shadows which overwhelm those of the landscape itself. We are only talking of the ordinary landscape when the effect of storms is not desired. It is not within the scope of this work to show how a landscape and a sky negative may be printed into one plate to form a transparency from which a new negative may be made; suffice it to say that, by using collodio-chloride, or by the use of a slow dry plate and exposing to candle light, the former may be produced in almost the same way that the print is produced, and a negative may then be produced in the camera or by a dry plate.

CHAPTER XI.

PREPARING THE PORTRAIT NEGATIVE.

So much has been written on the subject of what is called "retouching" the negative, that it would be a waste of space to enter very fully into details here. It is now generally admitted that working on the negative is not only legitimate, but that it is absolutely necessary, if a presentable portrait is to be printed. The only question is, where to stop. Professional retouchers, in too many cases, do too much, and by doing so they "overstep the modesty of nature," and turn the lovely delicacy, softness, and texture of living nature into the appearance of hard and cold marble statuary. Everything that is necessary to do to a portrait negative is very simple; it should be corrected, not remodelled. Freckles and accidental spots should be stopped out, high lights may be strengthened, and shadows softened. We may here briefly indicate the technical methods of performing these operations.

Some operators pour a solution of gum over the negative after fixing, and when it is dry work upon the surface of the gum; but it is better and safer to retouch the negative after it has been varnished. The varnish must be allowed to become thoroughly

hard before any working upon it is attempted. A negative varnished at night should be ready to be retouched the next morning. If very little has to be done to the negative, it may be done at once without preparation; but it is often advisable to prepare the surface of the varnish to take the lead pencil, with which the greater part of the work is done. This is done with "retouching medium."

Several preparations under this or similar names are sold by stock dealers, all of them giving, as far as we have tried them, equally good results. If the photographer prefers to make his own medium, he may do so by diluting mastic, or any similar varnish, such as copal, with turpentine. Apply the medium to the parts that it is intended to work on with the finger, and allow to dry, which it does in a few minutes. Place the negative on a retouching desk, and commence to fill up with the point of the pencil all spots that are not required, such as freckles or uneven marks. Some operators begin at the top of a face and work evenly downwards. This is a bad plan, and usually results in a mechanical flattening of the face; it is better to fill in here and there as necessity appears to arise. The high lights may now be strengthened, taking care not to make them violent or spotty. The shadows of the face will be found to require softening, but the general shape of the shadows must not be altered, and in modifying lines—such as the lines in the forehead and under the eye—take care not to remove them altogether. An old man without wrinkles is an unnatural and ghastly object—the "marble brow" of the poet should be left to literature. The best pencils to use are Faber's Siberian lead, the hard ones in preference. HH and HHH are the sorts usually employed. The pencils must be kept very finely pointed. To ensure this, a piece of wood covered with glass cloth should be kept always at hand on which to grind the leads to a point.

Sometimes there are portions of a negative that require more filling up than can be done with a pencil; in this case water-

ellipses vary as their two diameters multiplied together, the point *b* would receive only one-twenty-fifth the light that *a* received, and *c* about one-ninth.

In fig. 21 the card is raised one inch from the paper, and here *f g* is about three-quarters of *d e*, and *h k* about two-fifths; therefore, in this case, the light on B would be only four twenty-fifths, or about one-sixth of that acting on *a*, and about nine-sixteenths or one-half nearly on *c*. It is thus evident that the further away the card is, the more extended will be the gradations. Again, suppose, in the last figure, the bit of sky at *g f* was twice as bright as at *d e*, then the amount of light acting on *c* would be the same as that acting on *a*. It will thus be seen how important it is for proper gradation that the hole in the card should be exposed to an equally illuminated sky, or that some artifice should be employed to render the illumination equal, If we paste a bit of tissue paper over C D, this is accomplished, for then it becomes the source of illumination, and it is illuminated equally all over, since on every part it receives the light of the whole sky; but this is not the case if it is transparent to diffused light, and is never the case if it is exposed to direct sunlight, since a shadow of the hole is always cast on the paper beneath. If you choose to put another piece of tissue paper, (say) one inch above the hole, and extending over the whole length of the card, this difficulty is got rid of, and this last piece of tissue paper illuminates that pasted over the hole C D, and the gradations will then be nearly perfect.

Now to apply the above to forming a vignetting block.

Suppose we have a one-inch head to vignette and to show the shoulders and chest, to be of the size of a carte-de-visite, that the background is about a half-tone between black and white, and that but a trace of it shall appear above the head. To make a good vignette, the graduation from black to perfect white should lie within a limit of half an inch for a carte size portrait. The question then arises at what distance from the plate should a

vignetting card be cut to help this object, and what shape should be made the hole in the card. We take it that one-fifth of the light necessary to produce a full black tone would hardly produce any effect on the sensitised paper; knowing this and the size of the aperture, we can calculate exactly what height the card could be raised. Take the breadth between the shoulders that is to be fully printed as 1¼ inches, then by constructing a figure similar to figures 18 or 19 we shall find that the necessary height is about one-third of an inch.*

By judiciously cutting out an aperture in the card and vignetting, defects in a background may often be entirely eliminated from the print. Proceed in this way: Take a print of the portrait, and cut out the figure in such a way as to get rid of the defective background, and then place this on a piece of thick card (we prefer a thick card, since it will not sag easily, and thus alter the gradation), and cut out an aperature corresponding to it. The outsides of most carte-de-visite frames are raised from the glass about one-third of an inch; place the card on the front so that the

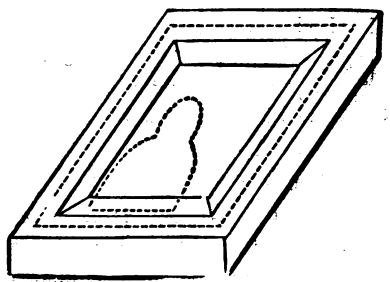

Fig. 23.

aperture corresponds to the figure on the negative, and tack it on to the frame. The dotted lines (fig. 23) show the card

* This calculation is near enough for our purpose. There are certain niceties which might be introduced, such as the "critical angle of the glass."

cut out the shaded pieces at the corners. Now bend the card along the cuts, and a raised block will result of this shape. The

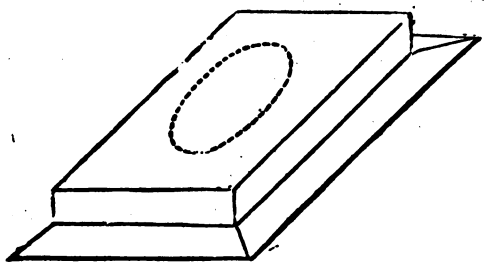

Fig. 2.

corners are held together by pieces of gummed or albumenized paper, and the block is ready for an aperture to be cut in it according to the portrait to be printed. Wooden grooves may be glued along the top of the vignetting frame, into which cards containing other apertures can be slipped.*

The most practical method of vignetting, a modification of the above, and the one we always prefer in our own practice, is as follows :—

Take a piece of soft wood, half an inch thick for a cabinet size—a thinner piece should be selected for a smaller picture—of a larger dimension than the negative; in the centre of this cut a hole of the shape of, but much smaller than, the desired vignette. One side of the hole should be very much bevelled away, as represented in this section (fig. 26). Place this block

Fig. 26.

on the glass of the printing-frame, bevelled side under, the hole

* The boxes in which children's puzzles are often packed will give an idea of what is meant.

sheet of the roughest drawing-paper, take a camel-hair brush dipped in thin sepia, and brush it evenly over the paper; the colour will fall into the depressions of the paper, and make the roughness still more visible. This should now be placed where a side light falls upon it, and photographed. A very thin negative is all that is required. This negative should be used in place of the plain glass, and, if not printed too dark, the effect of the delicate vignette inside the rough tint is very pleasing. It is better when using negatives for this purpose to place them in pressure-frames, instead of merely placing them or the print on the velvet board, to print, or perfect contact may not be obtained.

Medallions.—Medallions of oval and other forms are now a good deal used for small portraits. These are simply produced by gumming a mask, made of black or yellow paper, with an oval or other-shaped aperture, on to the negative, the mask preserving the part it covers white. These masks can be bought from the dealers cheaper and better than they can be made. Eccentric shapes are, usually, in bad taste; the oval and dome are quite sufficient for all purposes. If, instead of leaving the outside of the print—that protected by the mask—white, it could be tinted, the lights in the picture would have greater value, and the effect be improved.. To do this, the printed part should be covered with a black-paper disc corresponding with the mask used in printing, the print covered with glass, and exposed to the light until printed the required depth. In performing this operation it will be found convenient to gum the disc to the covering-glass. If texture could be added to this tinted margin, then another element of beauty would be added. This may be done in a similar manner to that described for vignettes, by using a negative made from rough drawing-paper; but, in this case, there is opportunity for a greater choice of objects from which to make the tinting negative, such as grained leather, marble of various kinds, paper-hangings—when suitable

patterns can be obtained—and from the borders of old prints. In this, as in many other things connected with photography, there is a good deal of room for bad taste, which the photographer must try to avoid. He must remember that all these surrounding designs should assist the portrait, and not distract the attention from it.

Vignettes in Ornamental Borders.—The writer has lately produced some effects that have given much pleasure by using designs specially drawn for the purpose. The designs principally consist of an oval in the centre for the portrait, and a tablet underneath, on which the original of the portrait may sign his name. These forms are surrounded by flowers and other objects conventionally treated. The spaces for the portrait and name should be stopped out with black varnish, so as to print white. The easiest way to use these ornamental border negatives is as follows:—First print the border negative; you will then have a print with a white oval space in the centre. Place this print on the portrait negative, taking care that it occupies the proper position in the oval. This is easily ascertained by holding the print and negative up to the light. It should then be placed in the frame and printed, care being taken that the vignetted gradation does not spread beyond its limits over the border.

There is a good deal of variety to be got out of the combination of the mask and vignette. Here is one of them.

Combination of Medallion and Vignette.—Vignette a head into the centre of the paper; when this is done, place over it a black paper oval disc, taking care that the head comes in the centre under the mask. Place a piece of glass over the whole, and print. When the disc is removed, the print will represent a vignette surrounded by a dark oval. Many variations may be made of this form of picture, and there is much scope for skill and taste.

Any of the tinting negatives above described may be used, or they can be made from designs drawn on paper as we have already stated, or from natural objects. But if our reader has followed us clearly thus far, he is now in a position to form combinations for himself. This we recommend him to do, for there is an additional beauty in anything in art that indicates a distinctive style or shows thought and originality. There is too much tendency in portraitists to run in grooves, which the universal prevalence of the two styles, card and cabinet, help to promote. But we must caution the young photographer against the mistake of making changes for the sake of change. The "loud," and the bizarre, may attract foolish people, but it is only the beautiful that will secure the attention of the cultivated and refined.

CHAPTER XIV.

COMBINATION PRINTING.

THE scope of photography is wider than those who have only taken a simple portrait or landscape suppose. It is almost impossible to design a group that could not have been reproduced from life by the means our art places at our disposal. We do not mean to assert that such subjects as Michael Angelo's Last Judgment, or Raphael's Transfiguration, for instance, have ever been done in photography; but it is not so much the fault of the art, as of the artists, that very elaborate pictures have not been successfully attempted. It has not been the failing of the materials, unplastic as they are when compared with paint and pencils; it has been the absence of the requisite amount of skill in the photographer in the use of them, that will account for the dearth of great works in photography. The means by which these pictures could have been accomplished is Combination Printing, a method which enables the photographer to represent objects in different planes in proper focus, to keep the true atmospheric and linear relation of varying distances, and by which a picture can be divided into separate portions for execution, the parts to be afterwards printed together on one paper, thus enabling the operator to devote all his attention to a single figure or sub-group at a time, so that if any part be imperfect, from any cause, it can be substituted by another without the loss of the whole

picture, as would be the case if taken at one operation. By thus devoting the attention to individual parts, independently of the others, much greater perfection can be obtained in details, such as the arrangement of draperies, the refinement of pose, and expression.

The most simple form of combination printing, and the one most easy of accomplishment and most in use by photographers, is that by which a natural sky is added to a landscape. It is well-known to all photographers that it is almost impossible to obtain a good and suitable sky to a landscape under ordinary circumstances. Natural skies are occasionally seen in stereoscopic slides and very small views; but I am now writing of pictures, and not of toys. It rarely happens that a sky quite suitable to the landscape occurs in the right place at the time it is taken, and, if it did, the exposure necessary for the view would be sufficient to quite obliterate the sky; and if this difficulty were obviated by any of the sun-shades, cloud-stops, or other inefficient dodges occasionally proposed, the movement of the clouds during the few seconds necessary for the landscape would quite alter the forms and light and shade, making what should be the sky—often sharp and crisp in effect—a mere smudge, without character or form. All these difficulties are got over by combination printing, the only objections being that a little more care and trouble are required, and some thought and knowledge demanded. The latter should be considered an advantage, for photographs, of a kind, are already too easy to produce. Of course, when a landscape is taken with a blank sky, and that blank is filled up with clouds from another negative, the result will depend, to a very great degree, upon the art knowledge of the photographer in selecting a suitable sky, as well as upon his skill in overcoming the mechanical difficulties of the printing. It is not necessary here to enter into a description of the art aspect of the matter, as that has often been discussed; so we will confine ourselves to the mechanical details.

that, in many places, the effect can be improved and the junctions made more perfect, especially when a light comes against a dark—such as a distant landscape against the dark part of a dress—by tearing away the edge of the mask covering the dark, and supplying its place by touches of black varnish at the back of the negative; this, in printing, will cause the line to be less defined, and the edges to soften into each other. If the background of the figure negative has been painted out, the sky will be represented by white paper; and as white paper skies are neither natural nor pleasing, it will be advisable to sun it down.

If a full-length figure be desired, it will be necessary to photograph the ground with the figure, as it is almost impossible to make the shadow of a figure match the ground on which it stands in any other way. This may be done either out of doors or in the studio. The figure taken out of doors would, perhaps, to the critical eye, have the most natural effect, but this cannot always be done, neither can it be, in many respects, done so well. The light is more unmanageable out of doors, and the difficulty arising from the effect of wind on the dress is very serious. A slip of natural foreground is easily made up in the studio; the error to be avoided is the making too much of it. The simpler a foreground is in this case, the better will be the effect.

The composition of a group should next engage the student's attention. In making a photograph of a large group, as many figures as possible should be obtained in each negative, and the position of the joins so contrived that they shall come in places where they shall be least noticed, if seen at all. It will be found convenient to make a sketch in pencil or charcoal of the composition before the photograph is commenced. The technical working out of a large group is the same as for a single figure; it is, therefore, not necessary to repeat the details; but we give a reduced copy, as a frontispiece to this volume, of a large combination picture, entitled "When the Day's Work is Done,'

by Mr. H. P. Robinson, a description of the progress and planning of which may be of use to the student.

A small rough sketch was first made of the idea, irrespective of any considerations of the possibility of its being carried out. Other small sketches were then made, modifying the subject to suit the figures available as models, and the accessories accessible without very much going out of the way to find them. From these rough sketches a more elaborate sketch of the composition, pretty much as it stands, and of the same size, 32 by 22 inches, was made, the arrangement being divided so that the different portions may come on 23 by 18 plates, and that the junctions may come in unimportant plates, easy to join, but not easy to be detected afterwards. The separate negatives were then taken. The picture is divided as follows:—

The first negatives taken were the two of which the background is composed. The division runs down the centre, where the light wall is relieved by the dark beyond it. These two negatives were not printed separately—it is advisable to have as few printings as possible—but were carefully cut down with a diamond, and mounted on a piece of glass rather larger than the whole picture, the edges being placed in contact, making, in fact, *one* large negative of the interior of the cottage, into which it would be comparatively easy to put almost anything. The next negative was the old man. This included the table, chair, and matting on which his feet rest. This matting is roughly vignetted into the adjoining ground of the cottage negative. The great difficulty at first with this figure was the impossibility of joining the light head to the dark background; no amount of careful registration seemed equal to effect this difficult operation; but if it could not be done, it could be evaded. Several clever people have been able to point out the join round the head, down the forehead, and along the nose, but we have never been able to see it ourselves, because we know it is not there. This is how the difficulty was got over. The figure was taken with

figure cut out accurately. Where the foreground and background join, the paper may be torn across, and the edges afterwards vignetted with black varnish on the back of the negatives. This mark is now fitted in its place on the landscape negative. Another print is now taken of the figure negative, and the white corner marks cut away very accurately with a pair of scissors. The print is now carefully applied to the landscape negative, so that the mark entirely covers those parts of the print already finished. The landscape is then printed in. Before, however, it is removed from the printing-frame, if, on partial examination, the joins appear to be perfect, two lead pencil or black varnish marks are made on the mark round the cut-out corners at the bottom of the print. After the first successful proof there is no need for any measurement or fitting to get the two parts of the picture to join perfectly; all that is necessary is merely to cut out the little white marks, and fit the corners to the corresponding marks on the mask; and there is no need to look if the joins coincide at other places, because, if two points are right, it follows that all must be so. This method can be applied in a variety of ways to suit different circumstances.

It is always well to have as few paintings as possible, and it frequently happens that two or more negatives can be printed together. For instance, the picture we have been discussing—"When the Day's Work is Done"—is produced from six negatives, but it only took three printings. The two negatives of which the cottage is composed was, as already explained, set up on a large sheet of glass, and printed at once; the old man was also set upon another glass of the same size, with the negative of the glimpse through the window; and the old woman was printed in like manner, with the corner group of baskets, &c. So that here were practically three negatives only. These were registered with corner marks so accurately that not a single copy has been lost through bad joins.

graphy cannot do; your sky does not match your landscape; it must have been taken at a different time of day, at another period of the year. A photograph is nothing if not true." Now it so happened that the landscape and sky were taken at the same time, the only difference being that the sky had a shorter exposure than the landscape, which was absolutely necessary to get the clouds at all, and does not affect the result. Another instance arose in connection with a picture representing a group of figures with a landscape background. Four of the figures were taken on one plate, at one operation; yet a would-be critic wrote at some length to prove that these figures did not agree one with another; that the light fell on them from different quarters; that the perspective of each had different points of sight; and that each figure was taken from a different point of view! These two cases are mentioned to show that it is sometimes a knowledge of the means employed, rather than a knowledge of nature—a foregone conclusion that the thing must be wrong, rather than a conviction, from observation, that it is not right—that influences the judgment of those who are not strong enough to say, "This thing is right," or "This thing is wrong, no matter by what means it may have been produced."

CHAPTER XV.

TONING THE PRINT.

If a print on albumenized paper be fixed without any intermediate process, the result is that the image is of a red, disagreeable tone, and unsightly. Moreover, it will be found that, if such a print be exposed to the atmosphere, it rapidly loses its freshness, and fades. In order to avoid this unsightliness, resort is had to toning, the toning, in reality, being the substitution of some less attackable metal for the metallic silver which forms a portion of the print. The usual metal used for substitution is gold applied in the state of the ter-chloride. It is not very easy to tell precisely how the subst tution is effected; the question is, at present, sub judice, and, therefore, we propose to omit any theory that may have been broached. It is sufficient to say that it is believed the first step towards the reduction of the gold is the production of a hydrated oxide, and never metallic gold. Be that as it may, if a finely-divided silver be placed in a solution of chloride of gold, the silver becomes converted into the chloride, and the gold is quickly reduced to the metallic state; and since gold combines with more chloride than does silver, it is manifest that when the substitution takes place,* the

* Silver subchloride and gold trichloride give silver chloride and gold.

$$3Ag_2Cl + AuCl_3 = 6AgCl + Au$$

metallic gold deposited must be very much less than the silver. The colouring power of gold is, however, very great, when in the fine state of division in which we have it, being an intense purple to blue colour, and a very little of this mixed visually with the ruddy or brown colour of the albuminate which has been discoloured by light gives, after fixing, a pleasing tone. A picture, when toned thus, is composed of silver subchloride, metallic gold, and an organic compound of silver. If a print be kept in the toning bath too long, we are all aware that the image becomes blue and feeble, and the same disaster happens when a toning bath is too strong, *i.e.*, is too rich in gold solution. The reason of this is, that too much gold is substituted for the silver in the sub-chloride, and there is in consequence too great a colour of the finely-precipitated gold seen. To make a toning bath, the first thing is to look after the gold. There is a good deal of chloride of gold sold, which is, in reality, not chloride of gold, but a double chloride of gold and of some such other base as potassium, and if it be paid for as pure chloride of gold, it is manifest that the price will be excessive. It is best to purchase pure chloride of gold, though it may be slightly acid, since subsequent operations correct the acidity. In our own practice we get fifteen-grain tubes, and break them open, and add to each grain one drachm of water, and in this state it is convenient to measure out. Thus, for every grain of gold to be used, it is only necessary to measure out one drachm into a measure. In delicate chemical operations, this would rightly be considered a rough method; but for a practical photographer it is sufficiently precise.

Now if chloride of gold alone were used, it would be found that the prints, after immersion in a dilute solution, were poor and "measley," and practice has told us that we must add something to the solution to enable it to act gradually and evenly. First of all, the gold solution must be perfectly neutral, and we know no better plan than adding to it a little powdered chalk, which at once neutralizes any free acid. It is not a matter of indifference

what further retarder is added, for the reason that the more you retard the action, the more ruby-coloured becomes the gold, and less blue. A well-known experiment is to dissolve a little phosphorus in ether, and add it to a gallon of water, and then to drop in and stir about half a grain of chloride of gold. Phosphorus reduces the gold into the metallic state, but when so dilute the reduction takes places very slowly. The gold will, however, precipitate gradually, but it will be in such a fine state of division that it is a bright ruby colour. A very common addition to make to a toning bath is acetate of soda, and if the gold be in defect, the same appearance will take place in the solution. If chloride of lime, however, be added instead, and a commencement of precipitation of gold be brought about, the gold will be of a blue colour, having a slight tendency to purple. In this case, the grains of gold deposited are larger than when it is in the ruby state. The tone of the print then depends in a large measure on the degree of rapidity with which the gold is deposited. The quicker the deposit, the larger and bluer the gold, whilst an extremely slow deposition will give the red form. It often happens that no matter how long a print is immersed in a toning bath, it never takes a blue tone. The reason will be obvious from the above remarks.

We now give some toning baths which are much used.

No. 1.—Gold tri-chloride	1	grain
Sodium carbonate	10	grains
Water	10	ounces

This bath must be used immediately after mixing, since the gold is precipitated by the carbonate. The tones given by this bath are purple and black. The prints should be toned to dark brown for the purple tone, and a slightly blue tone for the black tone.

No. 2.—Gold tri-chloride	... ...	2 grains
Saturated solution of chloride of lime		2 drops
Chalk	... ...	a pinch
Water	... ...	16 ounces

The saturated solution of chloride of lime is made by taking the common desinfecting powder, and shaking a teaspoonful up in a pint bottle. When the solids have settled, the clear liquid can be decanted off, and corked up till required. This is the solution used above. It is as well to keep this solution in the dark room.

The water with this bath should be hot (boiling better still), and the bath may be used when it is thoroughly cool. It is better, however, to keep it a day before using, since, when fresh, the action is apt to be too violent, and the prints are readily over-toned. The tone with this bath is a deep sepia to black. To get the first tone a very short immersion is necessary; the prints should be almost red. For a black tone the prints should be left in the solution till they are induced to be of a purple hue.

No. 3 is made as follows:—

Sodium acetate	... ...	1 drachm
Gold trichloride	... ...	5 minim
Distilled water	... ...	12 ounces

This bath is a most excellent one in many respects, and should not be used under a week to get the best result. As this is a long time to keep a bath, it as as well to have two always on stock. It keeps indefinitely if proper care be taken of it. This produces a purple or brown tone, according to the length of time the print is immersed in it.

Now, as to toning the print. After the day's printing is done, the prints should be placed in a pan of good fresh water, in order to dissolve out all or a certain amount of silver nitrate that is invariably left in them. A puncheon, such as is used in

The time required for fixing a print varies with the thickness of the paper used. As a rule, prints on the medium-sized paper require ten minutes' soaking in the bath, whilst thick-size requires fifteen minutes. Whilst toning, the dish containing the hyposulphite should be kept in a gentle rocking motion, as in toning, and for the same reasons. Prints may be examined from time to time, to see how the fixing progresses. When a print is not quite fixed, small spots of dark appearance will be seen when it is examined by transmitted light. The operation of fixing should be continued after these disappear for at least three or four minutes, in order that the hyposulphite of soda in the dish may get impregnated with the double silver and sodium salt which is in the print, and thus render washing more effectual. It should be noted that the dish for fixing should be at least as long and wide as the dish used for toning; that it should be deeper when, as a rule, all the prints are fixed at one time. Care should be taken that dishes which are used for sensitizing, toning, or fixing, *should not be used for anything else.* The glaze of porcelain dishes is often soft, and frequently absorbs a certain amount of the solutions used. Thus, if a porcelain dish be used for a solution of any aniline dye, it will often be found that it is permanently stained. Colour in this last is merely indication of what happens with any other solution. It will thus be seen that it is a mistake to use a dish or fixing when the glaze is cracked, since old hyposulphite must find its way into the body of the fresh solution that may be used, and thus institute a spontaneous decomposition, and a consequent want of permanence in the print. For our own part, we believe that a gutta-percha dish is a safer dish to use than any other, since it is impervious to any solution, and can be well scoured after fixing, and before being again brought into use. We believe that much of the fading of prints may be traced to the use of unsuitable dishes for fixing.

"It frequently occurs that though sodium hyposulphite cannot be detected in the washing water, it may be present in the paper itself. The paper on which most prints are taken being sized with starch, if a *very* weak solution of iodine be applied with a brush across the *back* of a print, a blue mark will indicate the *absence* of the hyposulphite. Care must be taken that the iodine solution is *very* weak, otherwise a part of the iodine will first destroy the trace of the salt, and then the remainder will bring out the blue re-action."

We finish this chapter by quoting our maxims to be observed in printing.

"*Maxims for Printing.*

"1. The prints should have the highest lights *nearly* white, and the shadows verging on a bronzed colour before toning.

"2. Place the prints, before toning, in the water, face downwards, and do not wash away too much of the free nitrate of silver.

"3. The toning solution must be neutral or slightly alkaline, and not colder than 60°.

"4. Tone the prints to purple or sepia, according as warm or brown prints are required.

"5. Move the prints, in both the toning and fix ng solutions, repeatedly, taking care that no air-bubbles form on the surface.

"6. Take care that the fixing bath is not acid.

"7. Use fresh sodium hyposulphite solution for each batch of prints to be fixed.

"8. Wash thoroughly after and before fixing.

"9. Make a sensitizing bath of a strength likely to give the best results with the negatives to be printed.

"10. Print in the shade, or direct sunshine, according to the density of the negative."

CHAPTER XVIII.

PRINTING ON PLAIN PAPER.

PRINTS on plain paper are sometimes of use; for instance, they form an excellent basis on which to colour. They are of course duller than an albumenized print, since the image is formed more in the body of the paper than on the surface. The following formula may be used:—

Ammonium chloride... ...	60 to 80 grains
Sodium citrate	... 100 ,,
Sodium chloride	20 to 30 ,,
Gelatine	... 10 ,,
Distilled water	... 10 ounces

Or,

Ammonium chloride	100 grains
Gelatine	10 ,,
Water	10 ounces

The gelatine is first swelled in cold water, and then dissolved in hot water, and the remaining components of the formulæ are added. It is then filtered, and the paper is floated for three minutes, following the directions given on page 10. If it be required to obtain a print on plain paper in a hurry, a wash of citric acid and water (one grain to the ounce) may be brushed over the back of ordinary albumenized paper, and, when dried, that side of the paper may be sensitized and printed in the ordinary manner. For cold tones the wash of the citric acid may be omitted.

The toning and fixing are the same as described in Chapters XII. and XIII.

Any of the toning baths given in Chapter XII. will answer, though Mr. Cooper recommends:—

Solution of gold tri-chloride (1 gr. to 1 dr. of water)	2 dr.
Pure precipitated chalk	a pinch
Hot water	10 ounces

2 dr. of sodium acetate are to be placed in the stock-bottle, and the above solution filtered on to it. This is made up to 20 ounces, and is fit for use in a few hours; but it improves by keeping.

In commencing to tone, place a few ounces of water in the dish, and add an equal quantity of the stock solution, and if the toning begins to flag a little, add more of it from time to time.

With the resin processes over-toning is to be carefully avoided.

Resinized paper may be obtained from most photographic dealers, we believe, and for some purposes is an admirable substitute for albumenized paper.

temperature of which should be about 150° F. to commence with. Saxe or Rive paper may be coated by rolling the sheet face outwards, and placing the edge of the roll upon the gelatine. The two corners of the paper in contact with the solution are then taken hold of by the fingers, and raised. The paper will unroll of itself, and take up a thin layer of the gelatine emulsion. The sheet of paper is then suspended to dry. All these operations are, of course, conducted in the dark room. The behaviour of the paper in the printing-frame is precisely the same as albumenized paper, and the washing and toning are conducted in the same way. For a fixing bath is used—

Sodium hyposulphite	2 ounces
Water	20 ,,

The washing after fixing is more rapid than with albumenized paper. It is washed in ten or twelve changes of water for ten minutes, and then placed for five minutes in an alum bath made as follows :—

Potash alum	5 ounces
Water	20 ,,

The print is washed in a few changes of water, and the prints are ready for drying and mounting. The advantage of the alum bath is that the hyposulphite is destroyed into harmless products, and the gelatine is rendered insoluble by it. In the formula given there is large excess of chloride, and we recommend that instead of using 2,440 grains of barium chloride, 2,050 grains be used. (Mr. Wilkinson has used that amount of the barium salt that would be required exactly to convert 1,700 grains of silver nitrate into silver chloride, if the formula for barium chloride were $BaCl_3$ instead of $BaCl_2$.) It will be seen that whichever formula is used, there is no silver left to combine with the gelatine, and hence the image will be entirely formed by metallic silver, and not an organic salt of silver.

CHAPTER XXI.

DRYING THE PRINTS.

In many establishments the prints are taken direct from the washing water, and hung up by American clips, and thus allowed to dry. When this is done, the prints curl up as the water leaves the paper, and they become somewhat unmanageable. If prints have to be dried at all before mounting—and they must, unless they are trimmed before toning—a better plan is to make a neat heap of some fifty or sixty of the same size (say cartes), place them on blotting-paper, and drain for a time, and then in a screw-press (such as is used to press table-cloths, for instance) to squeeze out all superfluous water. After a good hard squeeze the prints should be separated, and the plan adopted by Mr. England carried out. He has frames of light laths made, of about 6 feet by 3 feet, and over this frame is stretched ordinary paperhanger's canvas. The prints are laid on this to dry spontaneously, and they cockle up but very little. The frames, being light, are easily handled. After the squeezing is done, supposing the room in which they are placed be not very damp or very cold, the prints will be ready for trimming and mounting in a couple of hours. To our minds there is nothing superior to this mode of drying, since the squeezing in the press tends to eliminate every slight trace of hyposulphite which might be left in them.

edges of the pattern glass. It requires a little practice to prevent clipping the glass as well as the paper, but for small sized prints, such as the carte, the shears have a decided advantage over the knife.

For cutting out ovals, Robinson's trimmer is an excellent adjunct to the mounting-room, and in this case ovals stamped out of sheet brass are used as guides.

The figure will show the action of the trimmer. The small

Fig. 29.

wheel is the cutter, and, being pivotted, it follows the curve against which it is held. It is better to cut out prints with this trimmer on sheet zinc in preference to glass, the edge of the wheel being kept sharp for a longer time than where the harder glass is used. To use the trimmer, the print is placed on the sheet of zinc, the oval mask (or square mask, with slightly rounded corners) is placed in position on it. The wheel of the trimmer is brought parallel to, and against, the edge of the mask, the handle being grasped by the right hand, the thumb to the left, and the fingers on the right. A fairly heavy downward pressure is brought to bear on the trimmer, and at the same time the wheel is caused to run along the edge of the mask. The cut should be clean, and the join perfect, if proper care be taken. It is desirable to practise on ordinary writing paper before it is taken into use for prints. Square masks with very slightly rounded corners can be used; the smaller the wheel, the less curved the corners need be. It will be seen that there is a limit to smallness of the wheel used, since, if too small, the stirrup on which it is pivoted would rest upon the mask. The larger the wheel the easier is the cutting.

With larger sizes than the carte or the cabinet, mounting may

often have to be delayed, since it is easier to keep a stock of unmounted prints (say landscapes) unmounted than it is when they are mounted. In this case the prints should be put away as flat as possible. The plan of drying we have indicated takes out the "curl," but even then they will not be flat enough to be handily put away. We therefore recommend the practice of stroking the prints. A flat piece of hard wood, about 1 foot long and 1½ inch broad, and the thickness of a marquoise scale, has its edges carefully rounded off. The print is seized by one corner in one hand and unrolled; the face of the print is brought in contact with a piece of plate glass. The "stroker," held by the other hand, is brought with its rounded edge on to the back of the print near the corner held by the first hand. Considerable pressure is brought upon the stroker, and the print is drawn through between it and the plate. The print is then seized by another corner and similarly treated. By this means a gloss is put upon the print, and the creases and cockles are obliterated. The print is now ready for trimming.

It is well to have a square of glass with true edges cut to the size of the pictures. The prints should be trimmed upon a sheet of plate glass, a sharp penknife being used to cut them. A rough test for ascertaining if the opposite sides are equal is to bring them together, and see if both corners coincide.

It may sometimes be found useful to cut out a print into an oval. The following method for tracing any ellipse may be employed:—On a thickish piece of clean paper draw a line A B, making it the *extreme* width of the oval required. Bisect it at O, and draw D O C at right angles to A B. Make O C equal to *half* the smallest diameter of the ellipse. With the centre C and the distance O B, draw an arc of a circle, cutting A B in E and F. Place the paper on a flat board, and at E and F fix two drawing-pins. Take a piece of thread and knot it together in such a manner that half its length is equal to A F. Place the thread round the two pins at E and F, and stretch it out to

tightness by the point of a lead pencil. Move the pencil guided by the cotton, taking care to keep it upright. The resulting

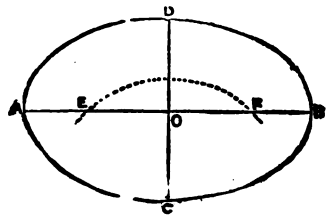

Fig. 30.

figure will be an ellipse. Modifications of this figure may be made by making a second knot beyond the first knot, and placing the point of the pencil in the loop formed. When the figure has been traced in pencil on paper, it should be carefully cut out with a sharp penknife, and placed on the print which is to be trimmed into an oval. When so placed, a faint pencil line is run round on the print, and the cutting out proceeds either by scissors or penknife.

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endeavour to find something which does not readily take up moisture. Glue, gelatine, dextrine, and gum are all inadmissible on this account; on the other hand, starch, arrowroot, cornflour, and gum tragacanth, when once dry, do not seem to attract moisture.

Referring to glue, Mr. W. Brooks says* that he has recently seen many photographs which have been mounted with that medium, and in some cases, where the glue has been put on too thickly, it swells up into ridges, showing marks of the brush with which it is applied, and each ridge after a time turns brown. The same writer is not wholly in favour of starch, but in our own opinion pure white starch is as good a material as can be met with. To prepare it for use as a mountant, a large teaspoonful of starch is placed in the bottom of a cup, with just sufficient cold water to cover it. This is allowed to remain for a couple of minutes, after which the cup is filled with boiling water, and well stirred; the starch should then be fairly thick, but not so thick as to prevent a brush taking up a proper supply for a good sized print. We will suppose that we are going to mount a day's work of carte-de-visite prints. In a former chapter we have said that it is desirable that the prints should be left damp. If they are dried, they should be *slightly* moistened, and placed in a heap one above the other, as by so doing the moisture is confined, and one damping of all the prints is sufficient. In our own practice we have, as is natural, all the prints with the faces downwards. A stiff bristle brush is then dipped into the pot containing the starch, and the starch brushed over the back of the top print. This one is then carefully raised from the print beneath it, and, supposing it to have been properly trimmed, it is laid upon the card, and pressed down by means of a soft cloth, and placed on one side to dry. The next print is then treated in the same manner, and so on. By this plan no starch gets on

* See Mr. W. Brooks' article in Photographic Almanac, 1881.

albumenizing; but in ordinary commercial samples the cause can be easily traced.

Red marks on the shadows may appear during toning, and are very conspicuous after fixing. They generally arise from handling the paper with hot, moist fingers after sensitizing; greasy matter being deposited on the surface, prevents the toning bath acting properly on such parts.

Weak prints are generally caused by weak negatives. Such can be partially remedied by paying attention to the strength of the sensitizing bath (see Appendix), and by using washed paper.

Harsh prints are due to harsh negatives. They can generally be remedied by paying attention to the mode of printing, as given in Chapter IX. If the negative be under-exposed and wanting in detail, there is, however, no cure for this defect.

A red tone is due to insufficient toning; whilst a poor and blue tone is due to an excess of toning.

The whites may appear yellow from imperfect washing, imperfect toning, imperfect fixing, or from the use of old sensitized paper.

Should prints refuse to tone, either the gold has been exhausted, or else a trace of sodium hyposulphite has been carried into the toning bath by the fingers or other means. A trace of hyposulphite is much more injurious to the print than a fair quantity of it. Should the toning bath refuse to tone after the addition of gold, it may be presumed that it is contaminated by a trace of sodium hyposulphite.

A dark mottled appearance in the body of the paper indicates imperfect fixing, combined with the action of light on the unaltered chloride during fixing. If the fixing bath be acid, the excess of acid combines with the sulphur, and forms hydrosulphuric acid, which will also cause the defect.

The cause of mealiness or "measles" in the print has been explained in page 32.

If the pictures required to be enamelled have been dried, it will be necessary to rub over them some ox-gall with a plug of soft rag; otherwise the water will run in globules on the surface, and make blisters when laid on the collodion.

"I may mention that prints done in this way lose their very glossy surface on being mounted, but retain their brilliancy, which I think is an improvement, as I dislike the polished surface usually given to the print when gelatine is employed."

CHAPTER XXVI.

CAMEO PRINTS.

At one time there was a rage amongst photographers to produce cameos. and, for this purpose, a special piece of apparatus was required to produce the embossing. The figure will explain it.

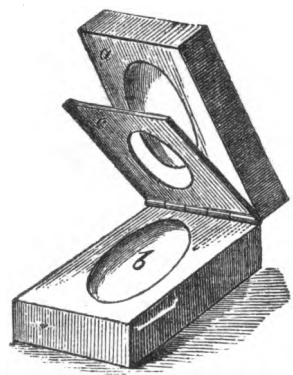

Fig. 31.

The print, after mounting, was enamelled by coating a plate with collodion—as described above—and a thin film of

liquid gelatine applied. In some cases the carte itself was gelatinized, dried, and damped, and placed in contact with the collodion film. The carte was placed face downwards on the gelatine, and placed under pressure till quite dry. It was then removed, and bore on its surface a high gloss caused by the collodion. It was then ready for embossing, which was effected by placing it in the above apparatus.

Some people like the style; and it will be seen that great variety in it may be made by printing sufficient depth of border round the cameo; but, for our own part, we think that, in an art point of view, they are decidedly vulgar; and besides which, the surface of the cameo is readily scratched, since it is raised. We only give a brief account of what has been done in this direction, not to encourage its adoption, but rather to caution the photographer.

no signs of getting lighter, but after about an hour the most perfect results had been obtained with prints considerably overprinted. With lighter pictures a less time is required. Proofs treated in this way lose nothing of their tone during the after-washing, which should be thoroughly done, and, when dry, retain all the brilliancy of an ordinary print."

The plan of using cyanide has, we know, often been proposed, but with no success until, we believe, Mr. W. Brooks gave a formula which worked successfully with him.

Another plan, proposed by Mr. L. Warnerke, for effecting the same thing is the use of ferric sulphate. A weak solution is prepared, and the print immersed in it. The reduction takes place rapidly, but evenly.

We need scarcely say that it is better not to have to use either of these remedies, by avoiding over-printing; but as mistakes will occur, it is evident that the above will be of use at times.

Utilization of Silver Residues.

All paper or solutions in which there is silver should be saved, as it has been proved by experience that from 50 to 75 per cent. of the whole of the silver used can be recovered by rigid adherence to the careful storage of "wastes."

1. All prints should be trimmed, if practicable, before toning and fixing; in all cases these clippings should be collected. When a good basketful of them is collected, these, together with the bits of blotting-paper attached to the bottom end o sensitized paper during drying, and that used for the draining of plates, should be burnt in a stove, and the ashes collected. These ashes will naturally occupy but a small space in comparison with the paper itself. Care should be taken that the draught from the fire is not strong enough to carry up the ashes.

2. All washings from prints, waters used in the preparation of

dry plates, all baths, developing solutions (after use), and old toning baths, should be placed in a tub, and common salt added. This will form silver chloride.

3. The old hyposulphite baths used in printing should be placed in another tub. To this the potassium sulphide of commerce may be added. Silver sulphide is thus formed.

4. To No. 1 nitric acid may be added, and the ashes boiled in it till no more silver is extracted by it. The solution of silver nitrate thus produced is filtered off through white muslin, and put aside for further treatment, when common salt is added to it to form chloride, and added to No. 2.

5. The ashes may still contain silver chloride. This may be dissolved out by adding a solution of sodium hyposulphite, and adding the filtrate No. 3.

6. No. 2, after thoroughly drying, may be reduced to metallic silver in a reducing crucible* by addition of two parts of sodium carbonate and a little borax to one of the silver chloride. These should be well mixed together, and placed in the covered crucible in a coke fire, and gradually heated. If the operator be in possession of one of Fletcher's gas furnaces he can employ it economically, and with far less trouble than using the fire. (It is supplied with an arrangement for holding crucibles, which is useful for the purpose.) After a time, on lifting off the cover, it will be found that the silver is reduced to a metallic state. After all seething has finished, the crucible should be heated to a white heat for a quarter of an hour. The molten silver should be turned out into an iron pan (previously rubbed over with plumbago to prevent the molten metal spirting), and immersed in a pail of water. The washing should be repeated till nothing but the pure silver remains.

The silver hyposulphite, having been reduced to the sulphide

* The crucible should be of Stourbridge clay.

by the addition of the potassium sulphide, is placed in a crucible, and subjected to a white heat; the sulphur is driven off, and the silver remains behind.

Another method of reducing silver chloride to the metallic state is by placing it in water slightly acidulated with sulphuric acid together with granulated zinc. The zinc is attacked, evolving hydrogen, which, in its turn, reduces the silver chloride to the metallic state, and forming hydrochloric acid. After well washing, the silver may be dissolved up in nitric acid.

Yet another method is to take sugar of milk and a solution of crude potash, when the silver is rapidly reduced. This requires careful washing, and it is well to heat the metal to a dull red heat to get rid of any adherent and insoluble organic matter which may have been formed, before dissolving it in nitric acid.

To Print from Weak and Hard Negatives.

Should a negative be found very hard, a slight modification of the sensitizing solution will be found beneficial, supposing the ordinary paper is to be used.

Silver nitrate	30 grains
Water	1 ounce

The negative should in this case be printed in the sun. The more intense the light, the less contrast there will be in the print, as the stronger light more rapidly effects a change in the albuminate than if subjected to weaker diffused light. The reason for the reduction in quantity of the silver nitrate in the solution is given on page 15.

To print from a weak negative, the sensitizing solution should be:—

Silver nitrate	80 grains
Water	1 ounce

The printing should take place in the shade; the weaker the negative, the more diffused the light should be.

If a negative be dense, but all the gradations of light and shade be perfect, the strong bath, and, if, possible, a strongly-salted paper, should be used. The printing should take place in sunlight.

To Make Gold Tri-Chloride [$AuCl_3$].

Place a half-sovereign (which may contain silver as well as copper) in a convenient vessel; pour on it half a drachm of nitric acid, and mix with it two-and-a-half drachms of hydrochloric acid; digest at a gentle heat, but do not boil, or probably the chlorine will be driven off. At the expiration of a few hours add a similar quantity of the acids. Probably this will be sufficient to dissolve all the gold. If not, add acid the third time; all will have been dissolved by this addition, excepting, perhaps, a trace of silver, which will have been deposited by the excess of hydrochloric acid as silver chloride. If a precipitate should have been formed, filter it out, and wash the filter paper well with distilled water. Take a filtered solution of ferrous sulphate (eight parts water to one of iron) acidulated with a few drops of hydrochloric acid, and add the gold solution to it; the iron will cause the gold alone to deposit as metallic gold, leaving the copper in solution. By adding the gold solution to the iron the precipitate is not so fine as if added *vice versa*. Let the gold settle, and pour off the liquid; add water, and drain again, and so on till no acid is left, testing the washings by litmus paper. Take the metallic gold which has been precipitated, re-dissolve in the acids as before, evaporate to dryness on a water bath (that is, at a heat not exceeding 212° F.) The resulting substance is the gold tri-chloride. To be kept in crystals this should be placed in glass tubes hermetically sealed. For non-commercial purposes it is convenient to dissolve it in water (one drachm to a grain of gold). Ten grains of gold dissolved yield 15·4 grains of the salt. Hence if ten grains have been dissolved, 15·4 drachms of water must be added to give the above strength.

To Make Silver Nitrate.

Silver coins are mostly alloyed with tin or copper. In both cases the coin should be dissolved in nitric acid diluted with twice its bulk of water. If tin be present there will be an insoluble residue left of stannic oxide. The solution should be evaporated down to dryness, re-dissolved in water, filtered, and again evaporated to dryness. It will then be fit for making up a bath. If copper be present, the solution must be treated with silver oxide.

The silver oxide thus formed is added, little by little, till the blue or greenish colour has entirely disappeared. This will precipitate the copper oxide from the copper nitrate, setting free the nitric acid, which, in its turn, will combine with the silver oxide. The copper will fall as a black powder mixed with any excess of silver oxide there may be. Take one or two drops of the solution in a measure, and add a drachm of water, and then add ammonia to it till the precipitate first formed is re-dissolved. If no blue colour is apparent, the substitution of the silver for the copper is complete; if not, more silver oxide must be added till the desired end is attained. Distilled water must next be added till the strength of the bath is that required. This can be tested by the argentometer.

If to a solution of silver nitrate a solution of potash be added, a precipitate will be formed. This is the silver oxide. The potash should be added till no further precipitation takes place. The oxide should be allowed to settle, the supernatant fluid be decanted off (a syphon arrangement is very convenient), and fresh distilled water added to it. This, in its turn, after the oxide has been well stirred, should be decanted off. The operation should be repeated five or six times, to ensure all nitrate of potash being absent, though its presence does not matter for a printing bath, since this or some other nitrate is formed when the paper is floated.